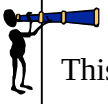
Chapter 8

Explosives

Purpose:

This chapter states the policy and procedures to be followed in the procurement, transportation, storage, and use of explosives at Hanford. Procedures equivalent in safety shall be supplied in other facilities for which DOE-RL is responsible.



Scope:

This chapter will address the following topics:

- Application
- Responsibilities
- Procurement and Delivery
- Transportation of Explosives
- Storage of Explosives
- Handling of Explosives
- Special Electrical Precautions
- Multiple Component Explosives
- Drilling
- Loading
- Equipment
- Wiring
- Firing
- Inspection After Blasting
- Misfires
- References
- Attachments

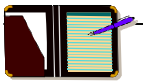
Application:

Regulations in this document shall be rigidly applied. In addition, the rules published in 29 CFR 1926, Subpart U, "Blasting and the Use of Explosives" shall be followed as a basic reference.

Responsibilities:

1. The DOE-RL Environmental Safety Division (ESH), or an operations contractor representative designed by the ESH, shall act as the "approving authority" referred to in this document.

2. The using contractor and his approved powderman shall be responsible for transporting, storing, and using explosives in



accordance with this subpart and the safe practices of the profession.

3. The using contractor shall furnish a qualified powderman, approved by the ESH Division or by a designated operations contractor representative.

4. The using contractor shall furnish a qualified powderman to obtain a "Blasting Permit" from the approving authority for the specific work and shall assure compliance with any restrictions impose.

5. The using contractor must procure his own explosives and other blasting materials and equipment suitable to the work and shall maintain accounts for all blasting materials brought onto Hanford Site.

6. The using contractor shall arrange for proper delivery of explosives onto the Hanford Site, including consigned blasting materials being delivered by vendor or commercial carrier.

7. The using contractor shall remove all blasting material and accessories from the Hanford Site within 30 days of "Blasting Permit" expiration. Materials not removed shall be confiscated without recourse or compensation.

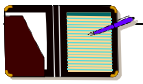
8. The RL Physical Security Branch shall inspect incoming delivery of explosives to insure compliance with these regulations. Deliveries not in compliance may be denied entry onto the Hanford Site.

9. The Physical Security Branch will provide escort service as necessary for on-site movements of explosives. In general escorts will be required for travel over primary site roads.

10. The Physical Security Branch shall regulate movement of explosives over site roads to minimize conflict with peal traffic conditions and will periodically inspect explosive storage for adequate security.

11. The approving authority (RL ESH Division or a designated operations contractor representative) may deny or invalidate a "Blasting Permit" for safety considerations at any time and may otherwise stop blasting operations any time unsafe practices, violation of regulations or working conditions warrant.

12. The RL ESH Division shall be made cognizant of all contemplated explosives use at Hanford and such activities shall be subject to ESH Division approval.



Procurement and Delivery:

1. The vendor will notify the RL Physical Security Branch at least twenty-four hours in advance of the expected delivery time of any explosive materials to the Hanford Site.

2. The Physical Security Branch will meet the explosives hauling vehicle at the entrance to the Hanford Site or the other designated location where they will inspect the vehicle for compliance with pertinent transportation regulations. If the vehicle is in compliance, Security will complete the form shown.

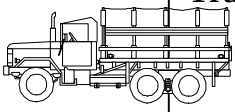
3. At the Hanford explosive magazine, available to multiple contractors, explosive materials will be unloaded and stored under the direction of Security, who will mark material containers for contractor ownership and date of storage.

4. All explosives in the storage magazines shall be issued and/or returned through Security.

5. Contractors may withdraw no more than daily requirements of explosives, shall provide continuous protection and identification of materials, and at the close of each working day shall return unused portions to magazine storage.

6. Separate field storage magazines approved by the approving authority may be located as directed (no less than Table of Distances for Class of material) and normally will not require Security contact for daily withdrawals.

Transportation of Explosives:



1. Electric blasting caps shall not be transported in the same vehicle with other explosives except under conditions specifically imposed by the approving authority.

2. Vehicles transporting exporting explosives shall be in excellent mechanical condition with no known defects. Particular attention shall be paid electric wiring to prevent short-circuiting.

3. Trucks transporting explosives on the Hanford Site shall be operated with extreme care and shall not be driven at a speed greater than 25 miles per hour. Full stops shall be made at approaches to all railroad crossings and main highways, and trucks must not proceed until it is known that the way is clear.

4. Explosives shall not be transported in any form of trailer nor shall any trailer be attached to a motor truck or vehicle hauling explosives.

5. No person other than the authorized driver and helper shall be permitted to ride on trucks transporting explosives or detonators.

6. Explosives shall not be transported during hours of darkness except to reduce a more severe risk.

7. The gasoline tank of a motor-truck shall not be filled while explosives are on the motor-truck except in emergency and then only when the engine of the motor-truck is stopped.

8. Explosives unloaded from trucks shall be placed at a sufficient distance from exhausts to prevent danger of sparks igniting the explosives.

9. Persons employed in the transportation, handling, or other use of explosives shall not carry on their person, in the magazine or in the truck, matches, firearms, ammunition, or other flame producing devices.

10. The following equipment is required for all vehicles used for the transportation of explosives on the Hanford Site:
    a) Chock block
    b) Grounding straps
    c) Backup lights
    d) Spark arrestor for exhaust pipe
    e) Quick disconnect switch on battery
    f) Four (4) red flags: two (2) in front; two (2) in rear
    g) Four (4) high explosive signs: one (1) in front; one (1) in rear and one(1) on each side
    h) Flashing amber light (visible 360)
    i) Emergency four-way flasher
    j) Rear view mirrors mounted on both sides of cab or vehicle
    k) Two (2) fire extinguishers filled and ready for use; one inside the cab shall have a U. L. Rating of 5:ABC; one outside the vehicle on the driver's side shall have a U. L. Rating of 20:ABC
    l) Positive means of securing explosives to the truck bed

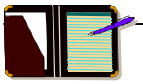
    For smaller quantities, which seem not to justify these precautions, a separate written procedure may be followed provided the procedure has prior written approval by RL-ESH.

Storage of Explosives:

1. Explosives shall be stored within the Table of Distances published in the Army Materiel Command Regulation (AMCR) 385-100.

2. Separate magazines shall be provided for storage of explosives and detonators. Special permission of the approving authority is required for storage of explosives other than at the Central Facilities Storage magazines. An audible, perpetual inventory record shall be maintained of all explosives stored and removed from storage.

3. *Rules for Explosives Magazines:* The following rules (paraphrased) recommended by the Institute of Makers of Explosives will be conspicuously posted in magazines containing explosives:
   a) Store only explosives in this magazine. Do not store blasting caps or electric blasting caps, blasting machines, flammables, sparking metal tools or other implements in this magazine.
   b) Handle explosives carefully.
   c) Store dynamite boxes flat, topside up. Corresponding grades and brands shall be stored together in such a manner that brand and grade marks will show, so as to be easily counted and checked and so the oldest stocks can be readily seen.
   d) Always ships, deliver, or use oldest stocks first.
   e) Do not throw or drop dynamite boxes. Do not slide them along the floor or over each other. Do not handle them roughly in any manner.
   f) Do not open packages of explosives, or pack or repack explosives, in a magazine or within 50 feet of a magazine.
   g) Use a wood wedge and a fiber, rubber or wood mallet to open or close wooden packages of dynamite.
   h) Do not use metal bale hooks in handling, or sparking metal tools to open, packages of explosives.
   i) All explosives must be stored in closed boxes.
   j) If artificial light is needed, use only an electric battery flashlight or lantern.
   k) Do not permit firearms or cartridges in or near this magazine.
   l) Keep the magazine clean.
   m) The magazine shall be kept in good repair and reasonably dry.
   n) Keep the area around the magazine sufficiently clear of leaves, grass, trash, stumps, and debris to prevent fire reaching the magazine.
   o) Do not allow unauthorized persons in or near magazine.
   p) Broken, leaky, or defective packages of explosives shall be safely disposed of as soon as possible. Dynamite shall not be stored longer than one year.



q) If any packages of dynamite are received in leaky or damaged condition put packages to one side in magazine and make report to ID Security.
r) Keep door securely locked when not working in the magazine.
s) Fuse, cordeau, or primacord may be stored in same building with dynamite.

4. *Rules for Blasting Supply Magazine:* The following rules(paraphrased) recommended by the Institute of Makers of Explosives for blasting supply magazines, will be conspicuously posted in magazines containing blasting caps, electric blasting caps, fuse, blasting machines, etc.:
   a) Store only blasting supplies in this magazine, i.e., blasting caps, electric blasting caps, blasting machines, etc. Do not store dynamite, powder, flammables, sparking metal tools, fuse, cordeau, primacord or similar materials in this magazine.
   b) Blasting supplies shall be handled carefully.
   c) Corresponding grades and brands should be stored together in such manner that brand and grade marks will show, so as to be easily counted and checked and so the oldest stocks can be readily seen.
   d) Always ship, deliver, or use oldest stocks can be readily seen.
   e) Do not throw or drop boxes of blasting supplies. Do not slide them along the floor or over each other. Do not handle them roughly in any manner.
   f) Do not open packages of blasting caps, electric blasting caps, or fuse until necessary to fill orders or to use them. Then close the package.
   g) Use a wood wedge and fiber, rubber, or wood mallet for opening or closing wooden boxes of blasting supplies, except where lids are screwed on, then use a screw driver. Do not keep any other metallic tools in the magazine.
   h) Do not use metal bale hooks in handling or sparking metal tools to open packages of blasting supplies, except where lids are screwed on, then use a screw driver.
   i) Do not have loose blasting caps, electric blasting caps or coils of fuse in the magazine or take them out of the original package until necessary to fill orders or use the.
   j) If artificial light is needed, use only an electric flash light or electric lantern.
   k) Do not smoke or carry matches, lighters, or other flame producing devices. Do not allow others to do so while in or near this magazine.
   l) Keep this magazine clean.
   m) If leak develops in magazine roof or walls, repair it at once.

n) Keep the area around the magazine sufficiently clear of leaves, grass, trash, stumps and debris to prevent fire reaching the magazine.
o) Do not allow unauthorized persons in or near magazine.
p) Use extreme care in opening or closing packages of blasting supplies.
q) Keep door securely locked when not working in the magazine.
r) Ammunition may be stored in this magazine under rules approved by the DOE-RL ESH Division.

Handling of Explosives:

1. Dynamite cartridges shall only be removed from containers, as they are needed for immediate use and carried to the blasting area in nonmetallic containers.

2. Explosives and detonators shall be taken to the blasting area in separate nonmetallic containers. Primers prepared at a central priming station may be carried in a separate nonmetallic container.

3. After loading of a blasting site is completed, all excess explosives and detonators shall be returned at once to the approved field storage magazine, observing the same rules as when being conveyed to the blasting area.

4. Whenever possible, electric blasting caps or similar electrically actuated devices, such as delay electric blasting caps and electric squibs shall be transported in their "as purchased" condition.

Special Electrical Precautions:

1. State-of-the-art precautions shall be taken to prevent premature explosions caused by "stray" electrical currents. Stray currents may be electromagnetic in origin, and may be generated by radio transmission equipment, snow storms, dust storm, thunder storms, nearby high voltage lines or equipment or other sources of electromagnetic or electrostatic energy.

   Five miles should be the closest approach of an electrical storm before a blasting operation is shut down. When any such source of ignition energy is possible, work with explosives shall cease and personnel shall evacuate the area. Work shall not again begin until the risk has been assessed and accepted by the approving authority.

2. In particular, the following precautions related to radio transmitters are required.

a) Electric blasting caps shall not be transported in a vehicle equipped with a two-way radio.
b) When it is necessary to use electric blasting caps and related devices in areas where radio transmitting is carried on, the following table of distances shall be followed:

Power:	Distance:
10 watts	5 feet
30 watts	10 feet
60 watts	15 feet
250 watts	50 feet

c) Care should be taken to prevent placing the wires parallel to the transmitter antenna.
d) Whenever possible the wires shall be placed on the earth.
e) Vehicular entrances to a blasting area shall be posted "Blasting – Turn Off Two-Way Radios." Such signs shall be no less than 50 feet from the blasting area and in approximately 6-inch letters. Sign shall be displayed only during blasting activities.

Multiple Component Explosives:

1. Multiple component explosives, e.g., carbo-ammomium nitrates, slurries, etc. shall be mixed, used, and stored only by a powderman fully experienced and qualified in the particular explosive he is to use.

2. When a multiple component explosive is to be used, it shall be controlled in detail by the blasting permit covering its use. The blasting permit may, in turn, impose the specific procedure of an authoritative reference.

3. Components, not in themselves classed as explosives, are not subject to the provisions of this Subpart until they are transported to a mixing or use site, or are placed in the vicinity of other components of the explosive.

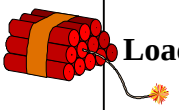
Drilling:

1. To allow for proper placement and effect of explosive charges, holes shall be drilled as directed by the powder man. He shall be kept informed of strata changes found in drilling.

2. Drilling shall not be started until all remaining butts of old holes are examined for un-exploded charges. A drill, pick, or bar shall never

be inserted in such holes even if examination fails to disclose explosives.

3. Drilling shall not be resumed after blasts have been fired until a thorough examination has been made to make sure that there are no un-exploded charges remaining.



Loading:

1. All loaded holes or charges shall be checked and definitely located before firing.

2. No more cartridges shall be primed than are required for single round of blasting. Detonators shall only be inserted in a hole in the end of a cartridge prepared especially for that purpose. Holes shall be made with a sharpened wooden stick.

3. Adequate precautions shall be taken to prevent flying rock from all blasting.

4. All holes loaded one day shall be fired the same day unless suitable precautions for guarding are furnished. Precautions taken must be as specified in the blasting permit.

Equipment:

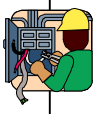
1. All blasts must be fired with an electric blasting machine except as in (b) below.
   a) When detonating cord is used, it shall be fired by the use of an electric blasting cap.
   b) For special Explosive Ordinance Disposal (EOD) missions non-electric techniques may be authorized as per procedures in US Army Field Manual FM 5-25.

2. Blasting machines must be known to be in good condition and of sufficient capacity to fire all charges. For blasting machines, the following performance rating shall apply.

   The machines shall fire without failure at least five times in succession, two electric blasting caps in series through resistance as follows:

Ohms:	# Cap Machine:
75	10
144	30
208	50
320	100

3. Rubber covered or other adequately insulated copper wires in good condition shall be used for firing lines and shall have solid cores. Sufficient firing lines shall be provided to permit the blaster and other workers to be located at a safe distance from the blast. Single conductor lead lines shall be used.



Wiring:

1. Each electric blasting cap shall be tested with an approved galvanometer before and after tamping a hole.

2. All caps in a blast shall have copper wire and shall be of the same manufacture.

3. After the leg wires of electric blasting caps have been tested, they shall be short-circuited by twisting the bare ends together and shall remain so twisted until ready to be connected into the circuit and the firing line.

4. All electric-blasting caps shall be wired in series and the firing line shall not be smaller than No. 14 B and S gage copper wire.

5. The circuit including all caps should be tested with an approved galvanometer before being connected to firing line.

6. The complete circuit, lead wires and firing line, should be checked with an approved galvanometer at the terminals to be connected to the blasting machine.

7. No firing line shall be connected to a blasting machine until just before the shot is to be fired.

Firing:

1. The using contractor shall coordinate the firing plan with other contractors in the area and give such direct notification as may be necessary.

2. Roadblocks shall be established as necessary to restrict access to the blast area.

3. An acceptable signal system shall be established where necessary to evacuate personnel with the blast area, and to sound an all clear.

4. Prior to the firing of a shot, all persons in the blasting area shall be warned of the blast and ordered to a safe distance from the area. A blast shall not be fired until it is absolutely certain that every person has retreated to a safe distance and that no one remains in a dangerous location.

Inspection After Blasting:

1. Immediately after the blast has been fired, the firing line shall be disconnected from the blasting machine and carried back a least half the distance from the blasting machine to the area of the blast.

2. The firing line shall be left in this position until all inspection and checking work has been completed.

3. The powder man shall carefully trace all wires, search for un-exploded charges, and make a minute inspection of the blast area before any other person(s) is allowed to return to the area.

Misfires:

When a misfire occurs, no corrective action shall be taken until the DOE-RL ESH Division has been notified. RL-ESH or its designated representative shall investigate and direct the methods(s) to be used to fire or remove the unfired charge(s).

References:

- 29 CFR Part 1926 Subpart U, "Blasting and the Use of Explosives."
- Recommended practices published by the Institute of Makers of Explosives.
- Army Field Manual FM 5-25.
- Army Materiel Command Regulation (AMCR) 385-100.

Attachments:

- Attachment 1: *Authorization To Blast At Hanford*
- Attachment 2: *High Explosive Vehicle Inspection Report*

U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE

AUTHORIZATION TO BLAST
AT HANFORD

To: _____ Date: _____
Company / Contractor Field Supt.

_____
Site Address

Mr. _____, Badge Number: _____, as your designated

blaster of _____, _____:
Company / Contractor Contract No.

has furnished evidence which satisfies OSHA 1926.901 Blaster Qualifications;

has been advised of contractual compliance responsibility with OSHA 1926 Subpart U, "Blasting and Use of Explosives," DOE-RL Standard Health and Safety Requirements for "Procurement, Transportation, Storage and Use of High Explosives at Hanford," and has a working knowledge thereof;

acknowledges the following specific limitations:

_____
_____
_____
_____
_____
_____

is hereby authorized to blast at the _____
Site Location

on the following day / dates _____

You are hereby advised that any significant violation of the prescribed standards or criteria can be cause for immediate stoppage of blasting operations and invalidation of this authorization.

_____
Authorizing Safety Official
DOE-RL

cc: Designated Blaster named
Safeguards and Security Division, Patrol Operation Section
Environmental Operational Safety and Health Division
Operation Contractor Area Safety Manager

NOTE: The designated blaster shall maintain a copy of this authorization in his possession during all applicable work.

U.S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE

HIGH EXPLOSIVES VEHICLE INSPECTION REPORT

Vehicle License No. _____

Inspected by	Date	Date of Use for Explosive Shipment	Emergency and Foot Brakes	All Lights	Fire Extinguishers Full and Sealed	Tires	Horn	Ground Cable	Fuel Lines and Wiring	Lift Gate

Instructions: All items to be checked prior to hauling explosives.

- 1 Copy to driver.
- 1 Copy to be retained by inspector.